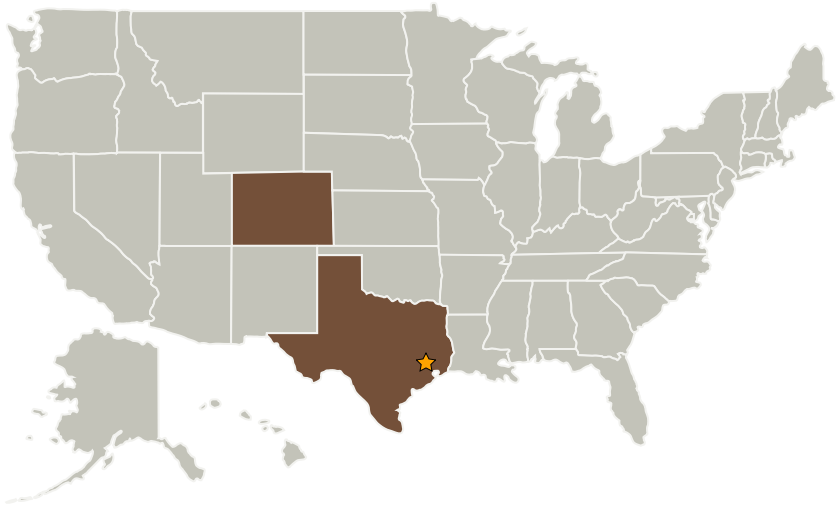
Carbon Monoxide Silicate Reduction System, Phase I

Completed Technology Project (2005 - 2005)

Project Introduction

The Carbon Monoxide Silicate Reduction System (COSRS) is an innovative method that for the first time uses the strong reductant carbon monoxide to both reduce iron and to evenly deposit carbon. This enables high temperature carbothermal reduction of silicon oxide yielding five times as much oxygen recovery from planetary regolith compared to hydrogen-based reduction systems. COSRS is an in situ planetary resource utilization process that yields useful oxygen and metals by reducing the majority of metal oxides in undifferentiated lunar, asteroidal, and Martian surface materials. The COSRS initially heats the materials to temperatures where the iron-bound oxygen combines with carbon monoxide, a strong reducing agent (reductant). Simultaneously, the produced iron metal catalyzes the disproportionation of carbon monoxide to carbon and carbon dioxide. The temperature is then raised for carbothermal reduction of the silicates, producing carbon monoxide, which is recycled back to the first stage process, and silicon metal. The carbon dioxide created in the iron reduction/disproportionation step is processed with hydrogen in a Reverse Water Gas Shift (RWGS) unit to make carbon monoxide and water. After electrolysis, the oxygen is stored while the CO is recycled to the reactor.

Primary U.S. Work Locations and Key Partners



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Organizational Responsibility

Responsible Mission Directorate:

Space Technology Mission Directorate (STMD)

Lead Center / Facility:

Johnson Space Center (JSC)

Responsible Program:

Small Business Innovation Research/Small Business Tech Transfer

Small Business Innovation Research/Small Business Tech Transfer

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Organizations Performing Work	Role	Type	Location
★Johnson Space Center(JSC)	Lead Organization	NASA Center	Houston, Texas
Pioneer Astronautics	Supporting Organization	Industry Historically Underutilized Business Zones (HUBZones)	Lakewood, Colorado

Primary U.S. Work Locations	
Colorado	Texas

Project Management

Program Director:

Jason L Kessler

Program Manager:

Carlos Torrez

Principal Investigator:

Mark Berggren

Technology Areas

Primary:

- TX07 Exploration Destination Systems
  - TX07.2 Mission Infrastructure, Sustainability, and Supportability
    - TX07.2.1 Logistics Management